Electrical Control Panel Specification
Scrubber Area- Unit 2 Electrical Panel 2SCB-LTCP-1B
Nathan Crop 2/22/06

1. GENERAL: Contractor shall purchase and fabricate one (1) free standing enclosure per attached drawings and provide all material as listed on the bill of materials. All materials shall be supplied by their corresponding vendors.

2. EXCEPTIONS: Contractor shall state "exception" or "no exception" to each item of this specification. Where exception is taken, contractor shall state the reason for the exception. Where questions exist, it is the responsibility of the contractor to contact the customer for clarification. Before fabrication begins IPSC reserves the right to review these specifications with contractor and the electricians to ensure correct construction.

3. MATERIAL REQUIREMENTS: This section gives details on the enclosure, panel, electrical devices and internal wiring.

   A. ENCLOSURES:

      (1) One (1) Enclosure, NEMA 4, wall mount (Hoffman A36H30BLP).
         a. 14 gauge steel.
         b. Contractor shall add support to make the enclosure free standing.
         c. Gasketed door.
         d. Enclosure size 36 x 30 x 8.
         e. Panel size 33 x 21.
         f. Number of door clamps five (5).
         g. No data pocket on door (Door shall be used for mounting hardware as per provided drawings).

   B. EQUIPMENT:

      (1) Equipment to be mounted in enclosures shall be listed on the bill of materials located on drawing no. D04393-E-YYY.
      (2) From left to right there will be four sections of vertical wiring duct installed between terminal blocks and relays. There shall be two horizontal ducts positioned on top and bottom for horizontal wiring.
         a. Panduit wiring duct part number:
            G1.5X2WH6- this panduit part number says it will be 1.5 inches wide and 1.5 inches deep. The "WH" says it is to be white and the "6" means it comes in 6 foot sections. The contractor will need to purchase three (3) 6 foot sections.
         b. Panduit wiring duct cover part number:
            C1.5WH6 - this panduit part comes in 6 foot sections and the contractor shall obtain three (3) 6 foot sections.

      (3) Any substitution to the bill of materials shall be approved by the customer prior to fabrication.

   C. MATERIAL: INTERNAL WIRING

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(1) Wiring from States terminal blocks to relays, lights and rotary switches.

Gauge:	14 AWG
Color:	Grey
Conductor:	41 strands in each conductor
Material:	Tinned Copper
Insulation:	SIS
Shielded:	None
Temperature Rating:	90 degree C
Voltage Rating:	600 Volts

Standards for wiring:

(2) Each wire shall have the "from" information labeled at each end (reverse labeling), using a wire label maker. The labels' information must be viewable when facing the inside of the junction box or the door.

(3) The internal wiring side shall be the right side of all States terminal blocks. This leaves the left side for field wiring.

D. INSTALLATION DETAIL:

(1) EQUIPMENT LAYOUT:

Use drawings D04393-E-XXX, D04393-E- YYY to layout and mount the hardware on and in the junction boxes.. Terminal blocks shall be mounted in the left section of the junction box spaced evenly. Relays to be mounted as shown just right of the terminal blocks evenly spaced. The wire ducts from panduit shall be spaced evenly. The indication lights, labels and rotary switches on door to be mounted lined up as indicated on drawing (Spaced evenly as possible).

(2) WIRING: Use the following drawings for wiring installation details:

D04393-E-XXX, D04393-E-ZZZ.

(3) JUNCTION BOX OUTSIDE LABELS:

a. All fifteen labels shall be plastic with black letters and white field as background. See drawing D04393-E-YYY for detail on wording of all labels. They are identified in roman numerals (i thru xv).
   i. Main label on junction box shall be located on the door, centered at the top, 1" below the top edge. The label shall read: 2SCB-LTCP-2
   ii. HS 1A or 1B in OFF
   iii. No Flow
   iv. Standby Start
   v. Pump 1A Running

vi. Pump 1A Stopped
vii. Pump 1B Running
viii. Pump 1B Stopped
ix. HS 1C or 1D in OFF
x. No Flow
xi. Standby Start
xii. Pump 1C Running
xiii. Pump 1C Stopped
xiv. Pump 1D Running
xv. Pump 1D Stopped

(4) JUNCTION BOX INTERNAL LABELS

a. Each terminal block and relay shall have a plastic tag centered just above or to the side of each item engraved with device description. Tag size shall be 2" long x 3/4" high x 1/8" thick. Tag shall be white background with black lettering. Lettering shall be 3/8" high.
b. Each indicating light and rotary switch shall be labeled with sticker labels. The sticker labels shall have black letters on white background. Size appropriately so normal vision is adequate for reading.
c. All labels shall be viewed without having to move or look around any obstructions such as internal wiring.

(5) TERMINAL BLOCK LABELS:

a. All States terminal blocks to be labeled in block letters according to the attached drawing designation. This is to be done on the terminal block marker strip. The numbering on the front and the lettering on the back.

(6) WIRE LUGS:

a. Connection at the States terminal blocks, relays, lights and rotary swithes shall be made with insulated ring tongue terminals appropriate for the wire size.

(7) WIRE WRAP:

a. The wiring between the back of the junction box and the front door shall be protected by wire harness wrap or loom tubing.

(8) INTERCONNECT WIRING:

a. Wiring throughout the junction box shall be neatly routed using wire duct specified above in these specifications.

4. EQUIPMENT INSPECTION: This gives the customer permission to come to the site of fabrication for inspection.

A. The contractor shall contact the customer at least 5 days prior to fabrication completion to schedule an inspection of the equipment for final checkout.

5. TESTING: The contractor shall make arrangements for testing.

A. After fabrication of the control panel the contractor shall test the functionality of all components (Rotary switches, Relays and indicating lights) as indicated in this section.

(1) Testing of relays: Continuity check on all relay contacts when coil is energized and de-energized (Even the contacts that we will not be using).

(2) Testing of lights: Application of 120 VAC to ensure that they turn on properly.

(3) Testing of rotary switches: Continuity checks on all contacts off of the rotary switches in each of the three positions of the switches.

(4) Testing of correct wiring: Continuity checks shall be preformed to ensure
a. All connections are as drawings specify.

6. SHIPPING:

A. The vendor shall provide shipping to IPP site, Delta, Utah following equipment inspection. The enclosure shall be protected internally and externally to prevent damage during shipping.

CRAIG B VAN OTTEN - CONTROL SOLUTIONS INC.
cbvo1@ix.netcom.com

Nathan,
Do to the fact that the A36H30BLP enclosure has a center door stiffener,
I would like to substitute a Hoffman CSD36308 Concept series enclosure.
This is still Nema 4 - 14 ga . steel. They are in stock in SLC.
When will drawings be available as well legend plate info for second panel?
Please advise ASAP.

Regards,

Craig

Work Scope for the:
"Installation of new Chilled Water Pump Control and Modification of 2SCB-LTCP-2."

Capital Project #: **IGS02-07 Induced Draft Fan Variable Frequency Drives**
Work Order #: 02-53663-

Project Description: We are replacing the controls for the chilled water pumps 1A, 1B, 1C and 1D. The control panel will be completely fabricated and ready for installation by the end of March, 2006. This job package includes work to be done in preparation for and throughout the replacing of the existing controls located in 2SCB-LTCP-1. This pre-outage work to be completed by the end of March 2006.

Scope of Work:

1. Install one (1) new 120 volt power cable (3/C #12) from 2APA-PPL-1D (See 2APA-E1641) breaker number 3 located in scrubber building column SB-202 ground floor (See 2EEC-E3327, 28, 29 and 30). The path of this circuit will be determined after a walk down. Cable should be routed through trays where possible. Some conduit will be required (3/4 inch rigid metal conduit). Change the fuse so it is 1 amp. We will use our standard cable tray rated cable.

2. Install four (4) new 5/C #14 cables (0.54 inch outer diameter) and one (1) inch RMC conduit from each of the four (4) buckets that feed chilled water pumps 1A, 1B, 1C and 1D. After a walk down of these circuit paths we will determine the length of 3/4 inch (rigid metal conduit) required. Each 2/C #14 has an outer diameter of 0.44 inches (Area of 0.152 in^2).
NOTE: For each of the size 2 buckets the 2/C will go across terminals 11 & 12 (Normally closed contact).

3. Install four (4) new 2/C #14 cables (0.44 inch outer diameter) and conduit from each differential pressure contacts located on the four pumps.

4. Install one new seven (7) conductor #14 cable from the new control panel downstairs to the input cabinet (Scrubber Common Modicon). These will require one (1) inch RMC conduit based on a 40 percent fill. This gives three conductor spares.

5. After all conduit is ran electrician shall go back and repair fire caulking at penetrations.

Notes:
A maximum of 2 feet of flex conduit shall be permitted where connecting to flow switches.
CH WTR PMP 1A IS FED FROM 2APC-MCC-2B33-6C (2APC-E1226) SIZE TWO BUCKET.
CH WTR PMP 1B IS FED FROM 2APC-MCC-2B33-6C (2APC-E1226) SIZE TWO BUCKET.

Materials Supplied by Owner:

a)

Nathan,
Here is the quote to date. I have authorized the vendor to proceed. This quote will have our standard mark up applied to it.
If this is in error please contact me immediately.
Bob

1CCE-K2000A_R011^C02-07~NRC.dwg
1CCE-K2000B_R008.dwg
1CCE-K2000C_R006.dwg
1CCE-K2101A_R005^C02-07~NRC.dwg
1CCE-K2101C_R003^C02-07~NRC.dwg
1CCE-K2102A_R005^C02-07~NRC.dwg
1CCE-K2102C_R003^C02-07~NRC.dwg
1CCE-K2111A_R004^C02-07~NRC.dwg
1CCE-K2111C_R002^C02-07~NRC.dwg
1CCE-K2112A_R004^C02-07~NRC.dwg
1CCE-K2112C_R002^C02-07~NRC.dwg
1CCE-K2113A_R005^C01-03~BRM.dwg
1CCE-K2113C_R002^C02-07~NRC.dwg
1CCE-K2114A_R004^C02-07~NRC.dwg
1CCE-K2114C_R002^C02-07~NRC.dwg
1CCE-K2121A_R005^C02-07~NRC.dwg
1CCE-K2121B_R004^C02-07~NRC.dwg
1CCE-K2122A_R004^C02-07~NRC.dwg
1CCE-K2122B_R003^C02-07~NRC.dwg
1CCE-K2123A_R004^C02-07~NRC.dwg
1CCE-K2123B_R004^C02-07~NRC.dwg
1CCE-K2124A_R004^C02-07~NRC.dwg
1CCE-K2124B_R004^C02-07~NRC.dwg
1CCE-K2131_R004^C02-07~NRC.dwg
1CCE-K2132_R005^C02-07~NRC.dwg
1CCE-K2601_R003^C02-07~NRC.dwg
1CCE-K2602_R004^C02-07~NRC.dwg
1CCE-K2606A_R003^C02-07~NRC.dwg
1CCE-K2606B_R004^C02-07~NRC.dwg
1CCE-K2606C_R004^C02-07~NRC.dwg
1CCE-K2805A_R004^C02-07~NRC.dwg
1CCE-K2805B_R005^C02-07~NRC.dwg
1CCE-K2806A_R003^C02-07~NRC.DWG
1CCE-K2806B_R006^C02-07~NRC.dwg
1EEC-E3327_R11^D02-07~NRC.dwg
63.3601.05-90153_R003.dwg
63.3601.05-90154_R003.dwg
63.3601.05-90155_R003.dwg
63.3601.05-90156_R003.dwg
63.3601.05-90232_R001.dwg
63.3601.05-90233_R001.dwg
63.3601.05-90239_R001.dwg
63.3601.05-90240_R001.dwg

IP7014127

INTERMOUNTAIN POWER SERVICE CORPORATION

B I D T R A N S M I T T A L

TO: _____ DATE: _____
Department Head

REQ. NO. _____ BID NO. _____

REQUISITIONER _____

BRIEF DESCRIPTION _____

Your prompt recommendation of award is desired on the attached bids. Recommendation should be made to the lowest bidder, or bidders, conforming to specifications. If proposal of lowest bidder, or bidders, cannot be accepted, reason must be stated in detail. Please advise by _____.

ANALYSIS OF BIDS:

☐ On a basis of price _____ is the lowest bidder quoting as shown.

☐ On a basis of price, the lowest bidders are as follows:

_____ _____
Buyer Purchasing Manager

RECOMMENDATIONS BY REQUISITIONER:

_____ _____
Approved by Department Head Date

IP7014128

Bill of Materials for Unit 1 C&D ID fan Drive Replacement

Item	Quantity	Description	Unit	Unit Price estimate	Extended Price estimate
01	2000 [FT]	14-7C XLP/HYP STR TNC XLP HYP JKT 600V VW-1 TYPE TC K2 (For new cable runs on new drives)	1000-FT	976.79	$1,953.58
02	2000 [FT]	14-5C XLP/HYP STR TNC XLP HYP JKT 600V VW-1 TYPE TC K2 (For just in case cable runs on new drives)	1000-FT	728.90	$1,457.80
03	22700 [FT]	8-3C TYPE TC CL B TNC FREP W/#10 GRD CPE 90C 600V VW1 M4 (For cable runs for power from ESS to all 16 drives for both units)	1000-FT	1158.96	$26,308.39
04	2000 [FT]	4 twisted pair cable This will go from a JBX on the exciter to the regulator of drive 1 and drive 2 of each fan. (2 spares per fan)	1-FT	1.63	$3,260.00
05	2	Junction Box electro-mate 1.0X1.5 (The one used on the U2 Delta fan is smaller. Its order # was 1210CHNF)			
06	60 FT	1" RMC This will go from the exciter JBX to the RMC.			
07	50 FT	1" FLEXIBLE CONDUIT TO GO FROM JBX'S TO RMC'S			LOT
08	2 TB'S THAT ARE 12 SLIDE LINKS LONG	THESE ARE FOR TERMINATING THE ENCODER SENSOR WIRING.			

Daily Log

Client	Intermountain Power Services Corporation (GD70107)
Contact	Jon Christensen Lead Electrical Engineer-Technical Services Intermountain Power Service Corporation 850 West Brush Wellman Rd Delta, Utah 84624-9546 USA TEL: (435) 864-6481 FAX: (435) 864-6670 e-mail: jon-c@ipsc.com
Job	Dual Channel Syncdrive
Location	Delta, UT

1. Thursday, March 6, 2004

Ivan Martorell (11)

- Traveled to site

2. Friday, March 5, 2004

Ivan Martorell (11.5)

- Reconnect shipping split wiring and plumbing.
- Replace Siemens circuit breakers with ABB.
- Ran CT wires back to the regulator channel 2.

3. Saturday, March 6, 2004

Ivan Martorell (11)

- Install MSH relay in channel 1 and wire.
- Install and wire SOR auxiliary contact both channels.
- Ran CT wire back to regulator channel 1.

4. Sunday, March 7, 2004

Ivan Martorell (10)

- Install and wire heater and thermostat in output switch
- Remove CT's from all incomers
- Re-torque all power connections and applied torque seal.
- Modify cable to D-sub connector on customer I/O boards.
- Drawing updates.

Mikhail Zakin (15.5)

- Traveled from Pittsburgh, PA to Delta, UT.

John Bradley (11)

- Traveled from Pittsburgh, PA to Delta, UT.

5. Monday, March 8, 2004

Ivan Martorell (11)

- Pressure test; 14 PSI start. Lost 1.5 lbs in 2 hours on Ch 1. Lost 2 lbs in 3 hours channel 2
- Slow leak at split between converters on Ch 2. Tightened union and left at 15 PSI overnight
- 13 PSI start. Lost 1 lbs at split. Maintained at 12 PSI channel 1
- Slow leak at split between converters. Tighten union.
- Leave 15 PSI overnight.

Mikhail Zakin (10)

- Completed pressure test on cooling system and cabling on both channels.
- Site safety course.
- Site set-up
- Tightness checked Ch 2 module wiring.
- Checked field wiring

John Bradley (12)

- Inspected installation. There appears to be a slight twisting in the drive frame that makes it difficult to mount the doors. Some minor work on the doors will be needed to ensure an easier fit. Perhaps fewer, or no, shipping splits can be looked into for future.

6. Tuesday, March 9, 2004

Ivan Martorell (10.5)

- Channel 2: left pressure @ 15Psi overnight, came in with 11 PSI. Tightened union at split between converters. Pressure dropped to 10 PSI in 1 hour. Tightened all unions at split between converters. Held 10 PSI for 3.5 hours (PASS)
- Channel 1: Held pressure @ 15 PSI (PASS)

Mikhail Zakin (10.5)

- Completed pressure test on cooling system and cabling on both channels.
- Ch 1 & Ch 2 water fill.
- Downloaded programs.
- Commission Ch 1 cooling system & measured all flows.

John Bradley (12)

- Completed cooling system fill and started pump circulation on both channels. No leaks and the system will run overnight.
- Completed power-on checks on channel 2
- Downloaded Ch 2 programs into the Sigma, cooling plc, Spang exciter and HMI.
- Updated the HMI program to reflect the correct unit and channel.
- Changed the transformer O/T trips to alarms.
- The diagnostics systems seems to be malfunctioning. The number of reads/write is not incrementing on Ch 2.

7. Wednesday, March 10, 2004

Ivan Martorell (11.5)

- Received CT's. Installed CT's in both channels
- Source locally plumbing fittings for drip pan and install
- Support the needle valves in all 4 incomers
- Replace 1 ground fault resistor
- Installed 6 missing jack screws

Mikhail Zakin (11.5)

- Completed O/C injection on Ch 1 & Ch 2.
- Completed D/O checks in Ch 1.
- Proved exciter contactor closing philosophy. Some cabling errors were found and rectified.

John Bradley (13)

- Spent most of the day working with IPSC staff on I/O checks.
- Rotated the motor by hand and measured the feedbacks. There is a concern that on Ch 1 the HV cabling to the motor may be swapped. If this is so, then we will have to correct it once we have established it to be so during single channel operation.
- Modified HMI code per IPSC staff requests. Rectified the exciter f/b's to the HMI as they were reading 10x too high. Added a decimal point to correct it. Also, added the digital output test points to the HMI to be able to force digital outputs from the HMI for test/fault finding purposes.

8. Thursday, March 11, 2004

Ivan Martorell (11)

- Installed MCCB1.
- Site clean-up.
- Helped with measurements for commissioning exciter.

Mikhail Zakin (10.5)

- Completed Ch 1 exciter checks.
- Tested remote I/O.
- Tested output disconnect switch.
- Site pack-up.
- Traveled to Salt Lake City.

John Bradley (13)

- Reviewed set up of Spang controller with Mikhail on Ch 1.
- IPSC staff continued on Ch 2 with i/o checks.
- To date there has not been one leak on the cooling system

9. Friday, March 12, 2004

Ivan Martorell (11)

- Traveled from Salt Lake City, UT to Pittsburgh, PA.

Mikhail Zakin (10.5)

- Traveled from Salt Lake City, UT to Pittsburgh, PA.

John Bradley (11)

- Started work on analog O/P's to customer.

- Tested inter channel torque references.
- Tested speed reference input. The original design had one speed signal wired in parallel to both channels and the Varichrons either selected or de-selected the signal depending on which one was master or slave. After discussion with Jon Christensen, he decided to split the signals and have two separate signals running from the control system to each channel.
- Started testing Analog outputs to Main Control Panel. Tested the analog output isolator and found it to be healthy.
- IPSC also started to prepare the 6.9kV breaker for the open and short circuit tests.

10. Saturday, March 13, 2004

John Bradley (11)

- Continued testing Analog outputs to Main Control Panel. The Current Feedback signals had a high burden resistance. Upon further investigation IPSC (Bob Wilson) found that the original system had a resistor in series with the meter (IPSC installed new panel meters). He rectified the problem and all the meters except Channel 1 Voltage Feedback were healthy. The said meter was found to be defective and will be replaced.
- IPSC charged the heat exchanger chilled water side pipe work and charged the heat exchanger once that was done.
- Started o/c and short circuit test on Ch 2. The open circuit curve looks a little rough. When we got to the s/c test the drive kept on tripping on earth fault

11. Sunday, March 14, 2004

John Bradley (8)

- Further to the ground fault problems discovered yesterday, we found that when the HV busbar fuses are pulled, the problem goes away. The problem is common to both channels. We went on to complete the closed loop short-circuit tests on both channels. This matter will be further investigated tomorrow by megger testing the entire system.
- When doing an inspection on the DC reactors it was noticed that the 15.1mH tap was selected. Our design called for the 12.1mH tap.
- Assuming nothing results from this we will attempt to run the motor tomorrow.

12. Monday, March 15, 2004

John Bradley (8)

- Further investigation into the ground fault problems revealed that there was not an actual ground fault but rather that there was some capacitive coupling that was causing the problem. After chatting to Dave Smith about it he researched the relay we were using at IPP and suggested another of a similar type but that had a time delay on it. Steve Klein said he would order it and have it delivered to site. These will be installed as soon as they arrive. For now however, I have made the instantaneous ground fault an alarm and added a delay ,G63, of W58msec as a trip. The ground fault current level has also been increased to 250mA. When the new relays arrive the alarm function can be removed from the program and the trip time set to 0msec.
- IPSC changed the DC reactors to the 12.1mH tap.
- As a result we completed the short circuit test on both channels.
- When doing the short circuit test on Ch 2 the drive started reacting very roughly. Further inspection revealed that supply arm 5 had 3 failed devices. The gate power supply was replaced with the customer spare. Since there was no conducting oil on site we could not change the devices. Steve Klein said he would get some to us tomorrow, with arrival on site on Wednesday 3/27/04.
- Added the Sigma core board temperature to the alarm annunciation to alarm at 50°C.

13. Tuesday, March 16, 2004

John Bradley (10)

- We intended running the motor today, however the customer operations department required certain documents/paperwork before permitting the run. This was taken care of by Jon Christensen. The planned motor run will be tomorrow.
- Investigation of the blown thyristor continued today. Started out by cleaning the flow meter used to measure the module flow. Rechecked the surge circuit & ground fault flows and they were all reading about 1.2 gpm. These were all changed back to 1.0 gpm. Having done this the module flow went to between 1.24-1-26 gpm. This was true for both channels. I then started to re-bleed the system and was able drop the header tank by about 1.5 gallons due to air reduction. The pressures and flows also went up to the following

	Channel 1	Channel 2
Supply Pressure (psi)	32	31
Return Pressure (psi)	25	26
Flow (gpm)	24	24

- IPSC maintenance personnel changes the Spang exciter controller in Ch 1 with the spare and calibrated it. The original will now be used as the spare.
- IPSC maintenance personnel replaced the cooler system FANUC PLC and downloaded the program. The original will now be used as the spare.

14. Wednesday, March 17, 2004

John Bradley (10)

- We had problems with the switch key interlocks again. This time the lock on the front that interlocks the manual mechanism has failed. It appears as though the rotating pin in the centre of the lock has moved off its corresponding alignment slot on the stationary part of the lock after the key was removed and the key can now no longer be put in to the lock. Further to this, I am not sure about removing the mechanism to repair it as it appears to require a special tool to remove the bolts holding the locking mechanism box.
- The planned run on the motor started at about 14h00. There were a few problems that were initially encountered. Firstly, the UPS supply voltage is rather low (104Vac) and when a run is attempted the output disconnect switch motor current is enough to drop this supply to a level that causes the cooling system plc to power off and on again as soon as the starting current drops. Consequently the cooling system would trip and trip the drive. As a temporary solution we are running all 120Vac supplies from the non essential supply until IPSC resolve the issue. There is a UPS that is local to the drive building that may be a solution.
- The second problem encountered was that the motor would not turn. After rolling the encoders through all the patterns several times I decided to realign the encoders. This will be done tomorrow after the motor is uncoupled and free to turn by hand.

15. Thursday, March 18, 2004

John Bradley (12)

- Motor turning test from Ch 1 began with the following problems being discovered. The HV leads from the drive to the output switch had the A & C phases swapped. Consequently the alignment work done by ED Fabean was questionable. What he did do however was enough to enable us to get the motor turning and we found that channel 2 stator volts leads channel 1, but the leading encoders were taken to channel 1 instead of 2. This was rectified. This done, we were able to get reliable starts from the fan with every start attempt. When trying to release the V/f regulator though we found that the machine kept bouncing between in and out of V/f. The stator volts were also very low. I found that the exciter kept on tripping and eventually was led to monitoring the stator voltage relative to speed and exciter current. In

order to produce the correct stator volts at the 7% speed the motor requires about 33A on the exciter. By comparison, the A Fan that is running at 150rpm and drawing about 250A dc is only drawing about 25Aac on the exciter. Consequently, as soon as it releases the V/f regulator the exciter current spikes and causes an exciter fault and consequently a channel trip, and so the drive tries to chop over. I am going to need to modify the logic some, however tomorrow we are going to start looking for failed exciter diodes. In light of this I am going to review the exciter setup and see if it cannot be set up to make damage to the devices impossible.

- The fan is coming down tomorrow for work that I&C needs to do on it and so we cannot run tomorrow. We will therefore repair the failed module in Ch2 and if any motor exciter diodes have blown we shall repair them too.
- IPSC personnel repaired the key interlock on Ch2 output disconnect operating mechanism.

16. Friday, March 19, 2004

John Bradley (12)

- Since the drive was down for work that I&C needed to complete, we took advantage of the day to complete Ch1 SC1 Arm 5 device repair. The original devices were from group 4 and the 5 spares are from group 2. Consequently all 5 were replaced. The module was replaced and tested. The short circuit test will be done tomorrow.
- The motor heater is also tripping out the 25A MCB in Ch1. IPSC staff investigated this and found that the cabling was replaced incorrectly after the 14 way States type TB1A. The orange core of cable 2CCEK213406 was landed on TB1A:10 instead of TB1A:11. Thus it was effectively grounded by the neutral of the 208V heater supply to the panel. IPSC personal resolved this issue.
- The motor exciter was tested and no fault was found. I reviewed the controller setup and changed it to output current regulation mode instead of open loop control and limited the output current to 50A. The preset controller output is going to have to be raised to a significantly higher value to achieve the rated 76.3% V/f at startup. What was happening previously, I suspect, was that the preset was too low, consequently when the V/f regulator was released, the was applying too much current to the exciter thus tripping on over current at 50A. The new exciter setup now limits the current to 50A and the trip to 90 Arms. The overload remains at 55Arms for 10sec.

17. Saturday, March 20, 2004

John Bradley (12)

- IPSC spent much of the morning looking into the i/o for the remote control. We are experiencing a problem with the bleed through on the 120V ac for the OFF, RUN TG and START commands from the customer Modicon. Even when the remote plc removes the command, there remains enough bleed through the switched output to keep the digital input to the Sigma high. Several possibilities have been suggested including wiring relays at the Modicon and using a relay output, using 24Vdc opto-isolators in the drive; using pull down resistors in the Modicon etc. Jon Christensen decided to use the 24V opto isolator in the drive as the final solution. These modifications will be completed tomorrow.
- Drive running commenced at about 10h45. The starts to date have been 100% successful on Ch1. The drive transitioned into V/f regulation seamlessly and into mode 2 seamlessly. As we could only take the fan up to 150rpm, no further testing could be achieved on this channel.
- We then went on to Ch 2 and repeated the short circuit tests in order to gain more light on the recent device failures that were experienced on Monday, March , 2004. For this test we connected the flow meter in series with arm 5 (on which the failures occurred) and did the short circuit test. At no time was there an interruption in flow and the chill block temperatures went up to a max of around 105 F for about 410A DC.
- Ran Ch2 for the first time today. After rectifying some code problems experienced on the inter channel slave interlocking, Ch2 starts reliably.
- The interface to the Modicon plc needed some change. The original drive had an Ampguard output disconnect/contactor. The feedbacks from the contactors were used to supply interlock and convey certain feedbacks in the Modicon. Since the output disconnect/contactor is replaced with a disconnect,

these feedbacks to the Modicon are obsolete. Jon Christensen and I went over the logic and reviewed the changes that need to be done in order to accommodate the change.

18. Sunday, March 21, 2004

John Bradley (10)

- Wired in the remote OFF, START, TG, RUN 24V dc isolators for digital i/p's to both CH1 & Ch2.
- Landed cabling for output switch feedback to the Modicon.
- We attempted the first dual channel run today without much success. I will review the inter channel i/o this evening.

19. Monday, March 22, 2004

John Bradley (12)

- We attempted the dual channel runs again today without success for the better part of the day.
- Toward the evening we found the problem and got the fan running in dual channel mode at night. It turns out that the 12P Master and 6P Master were interlocked with each other. This removed, the fan ran up on dual channel mode without a problem.

Dave Smith

- Ran the fan in dual channel mode.

20. Tuesday, March 23, 2004

John Bradley & Dave Smith (12)

- Ran the fan in dual channel and successfully chopped from one channel to another by simulating an exciter failure.
- Continued with logic checkouts, rectifying any errors as we went along.

21. Wednesday, March 24, 2004

John Bradley & Dave Smith (13)

- Installed the new ground faults relays, set them up and tested them.
- Replaced labels that had incorrect spelling.
- Proved two phases of chop over failure to John Benz (S&L) & Nathan Crop (IPSC), i.e. Master exciter failure & Master trip.
- Proved loss of remote speed reference to John Benz (S&L) & Nathan Crop (IPSC).
- Proved cooling pump chop over to John Benz (S&L) & Nathan Crop (IPSC).
- Proved loss of encoder supply in mode 2 alarm.
- Prove regenerative braking.
- Continued with logic checkouts, rectifying any errors as we went along.

22. Thursday, March 25, 2004

John Bradley & Dave Smith (15)

- Ran the drive in dual channel mode taking recordings at various intervals. Ch1 is giving a random pulsation that is symptomatic of a hardware problem. It only starts occurring after about 300rpm under load. We continued to run the fan up to about $\alpha = 60°$ and noticed that machine arm 2 "supporting volts" indication on the gate cards flickered sympathetically with the pulsation. We decided to run down and inspect the drive which revealed nothing.

23. Friday, March 26, 2004

John Bradley & Dave Smith (14)

- Swapped the machine PAB and ribbon between channels. The fault witnessed yesterday moved from Ch1 to Ch2. We then swapped the PAB's back again and the fault moved back to Ch1. Replacing the PAB in Ch1 with the customer spare cleared the fault.
- The motor was then ran again up to 850rpm and readings were taken at various speeds. Dave Smith and I further optimized the drive. We were not able to get the drive to full speed but were told by John Christensen that we may be able to get it there tomorrow.

24. Saturday, March 27, 2004

John Bradley & Dave Smith (8)

- Today we adjusted the motor voltage to 3070V and after further adjustments to optimize performance the fan was returned to service. The new settings were verified. Based on the results of this run and information from Jon Christensen that the nominal voltage on the 6.9kV bus is lowered to about 6.3kV under full load conditions it was decided to lower the input transformer by one tap, thus raising the input voltage to the drive by 2½%. This done and further optimization, the drive was returned to service and is going to be used to get the boiler in service. Jon Christensen informed us that the boiler was due to be at 950MW on Monday at which time it may be possible to get full speed full load out of the fan.

25. Sunday, March 28, 2004

John Bradley & Dave Smith (8)

- On arrival at site we found that Ch2 supply arm 3 device 4 (SB1-9) had failed. It was replaced with one of the same group that was removed from Ch2 supply arm 5 on Friday, March 19, 2004 and the fan returned to service.
- We made further optimisation changes to the code and downloaded to both channels. We have been chopping between channels in order to keep the fan in service with successful chop overs every time.
- While running, Ch2 underwent a fault. Dave Smith heard the actual fault occurring and tripped the channel locally. Upon investigation we found that the gate card of Ch2 supply arm 2 device 2 (SC1-2) had failed. Further investigation showed that the chill block thermostat on all the negative DC arms were landed on the cathode of device 1 but wired to device 2 gate card. We moved the thermostat to (2 Channels x 6 module's thermostats = 12 in total) to device 2 cathode chill block and replaced the failed gate board with a customer spare.

26. Monday, March 29, 2004

John Bradley (8)

- On arrival at the fan was running at about 660rpm. I was informed that the unit was loaded to about 800MW. The drive had run through the night without trouble. No alarms or failures were found.
- Arranged to ship the failed PAB located on Friday and the gate PSU to Pittsburgh.
- Jon Christensen and I reviewed the design (cabling) for accuracy.
- By the end of the day the fan was running at about 700rpm.

END OF VISIT

610 Epsilon Drive
Pittsburgh, PA 15238
USA
Ph: (412) 967- 0765
Fax: (412) 967- 9422

DAYWORKS

W/E 4/2/04

Contract No. GD70107

Alloc. No.

CUSTOMER: Intermountain Power Services Corporation

PROJECT: Unit 2 ID Fan 1D VFD

DESCRIPTION: Dual Channel Syncdrive

NAME	CLASS		Sa	Su	M	Tu	W	Th	F	TOTAL	@RATE	$	$
John Bradley		Time Start	8	8	8					24			
		Time Finish											
		Hours											
		Time Start											
		Time Finish											
		Hours											
		Time Start											
		Time Finish											
		Hours											
		Time Start											
		Time Finish											
		Hours											
		Time Start											
		Time Finish											
		Hours											
			SUBTOTAL										
			ADD PERCENTAGE ADDITION								...%		

HIRE of PLANT & EQUIPMENT			Sa	Su	M	Tu	W	Th	F	TOTAL	@RATE	$
			SUBTOTAL									
			ADD PERCENTAGE ADDITION								...%	

MATERIALS AND EXPENSES	QTY	UNIT	RATE	$
SUBTOTAL				
ADD PERCENTAGE ADDITION ...%				

TOTAL

$

SIGNED: _____ SIGNED: _____

ALSTOM CUSTOMER

PRINT NAME: _____ PRINT NAME: _____

ALSTOM Power Conversion
610 Epsilon Drive
Pittsburgh, PA 15238
www.alstom.com

White- Customer/ Subcontractor *Yellow- Contracts* *Pink- Field Operations* *Gold- Site*

IP7014139

Shaft Encoders for SYNCDRIVES

For the Alstom Sigma based syncdrives it is necessary for the motor to be fitted with shaft position sensors. A description of the operation of the sensors and a recommendation for their placement is given below.

Function

The shaft encoders connect into the sigma digital I/O board using three (or six on dual wound single sigma systems) dedicated 24v digital inputs. These inputs are connected by the system firmware into the machine converter firing circuit. They are used during starting and low speed operation when the available back emf from the machine is insufficient to commutate the machine converter thyristors. Based on the pattern of received sensor feedback the firing circuit firmware determines which pair of machine bridge thyristors will conduct at any particular instant in time.

With the machine at standstill, the encoder pattern selects with thyristors and hence which phases of the stator will carry current. The direction of current flow is also selected. When the machine is turning the encoder determines when the stator current is transferred from one phase to another so that maximum torque is maintained at all times.
Once a certain speed is reached (normally around 10-12%) the machine can produce enough back emf to naturally comutate the thyristors, the encoders are then only used as a supplemental source of speed feedback.

Mechanical Arrangement

The encoder arrangement varies with machine pole number. There is always one rotor lobe per pair of motor poles and the rotor lobes always cover an arc of 180° electrical.

There are 3 or 6 inductive proximity sensors separated by an angle of 120° electrical. Each sensor produces an output voltage while sensing the presence of a rotor lobe. When the motor is turning at constant speed, each sensor produces a nominally square wave output voltage. In the case of six phase or dual wound machines, the second set of encoders have the same 120 degree electrical separation but are displaced 30 electrical degrees lagging the first set.

Provision should be made for angular adjustment of all three or six sensors simultaneously, by mounting them on a common slotted ring bolted to the machine housing. The slot range of adjustment should cover a 120° electrical arc. The mechanical arrangement should allow angular adjustment to be done without disturbing the air gap settings.

Initial Sensor Alignment

Check that the sensors are positioned so that with the motor shaft at its magnetic center, the sensor tips are at the axial center of the rotor lobes. The axial width of the rotor lobes should be such that no part of the sensor tip ever extends beyond the lobe surface at the limits of shaft end play.

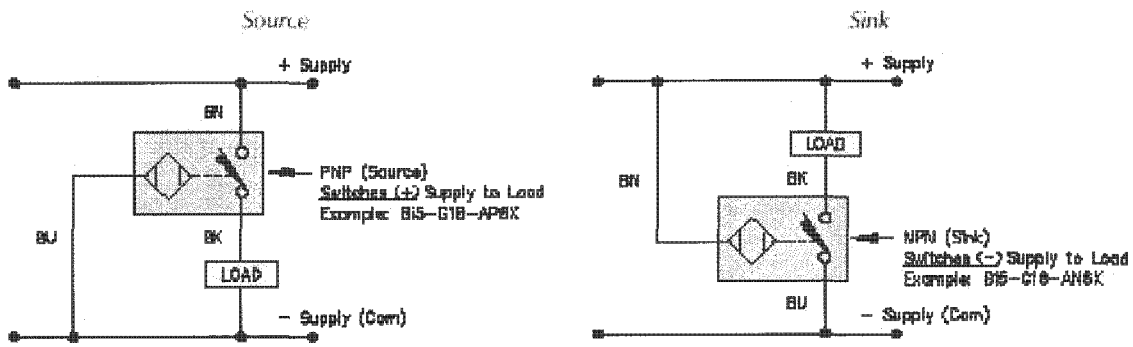
Check that the sensor bodies fan out radially from the shaft center and that they are also perpendicular to the shaft axis. The object is to ensure that the sensor tip is essentially parallel to the surface of the rotor lobe.

Sensor Air Gap Setting

Generally, the air gap between the sensor tip and rotor lobe surface should be set to 0.047 ± 0.004 inches. (1.2 ± 0.1mm) With this gap setting the sensor should switch to the on state when the edge of the rotor lobe just covers half the sensor tip.

DC power supply requirements for sensor testing

A suggested method of connection for the three wire Turck and or Pepperl & Fuchs type of encoders is shown below. The load can consist of a 10K ohm resistor.



Electrical Check of Encoder Operation

Having first set the sensor air gaps, the motor should be turned to check that all three sensors produce an output voltage across their load resistors. When a lobe is sensed, the output voltage should be 24v (or whatever V supply is used) In the absence of a lobe, the output voltage should be less than +1 volt. Check that each sensor changes state when approximately half the sensor tip is covered by a lobe.

If the motor can not be turned, a suitably shaped ferrous metal object can be used in place of the lobe (e.g., a screwdriver).

Setting of Encoder Phasing

It is suggested that the motor be run as an unloaded generator at some convenient low speed and that a comparison be made between the phasing of the induced stator voltages and the sensor signals.

First determine the specified direction of rotation for the motor and check electrically that the phase sequence of the induced stator voltages is 1,2,3 (or A,B,C) as marked on the stator cables/terminals. Also verify which motor winding is leading (in the case of a dual wound motor).

Permanently label each sensor and it's leads 1,2,3 (or Delta1, Delta2, Delta3, Wye1, Wye2, Wye3 in the case of a six phase machine) in the order in which the sensors come up as determined by the specified direction of shaft rotation. Sensor 2 will always be the middle sensor in the group. It must be noted that the leading winding is associated with the first set of encoders and the lagging winding with the second set of encoders.

With the encoders set up as shown in the above diagram, connect a single phase suitably rated potential transformer (with the secondary winding having the same polarity as the primary, as indicated by the dots on the windings) to the stator windings of the machine.
Adjust the angular position of the encoder mounting ring so that the phase relationship between the rising edge of the encoder signal and the positive going zero crossing of the stator voltage waveform conform with the following table.

1. Encoder 1 positive rising edge is in phase with the positive going zero crossing of stator phases 1-2
2. Encoder 2 positive rising edge is in phase with the positive going zero crossing of stator phases 2-3
3. Encoder 3 positive rising edge is in phase with the positive going zero crossing of stator phases 3-1

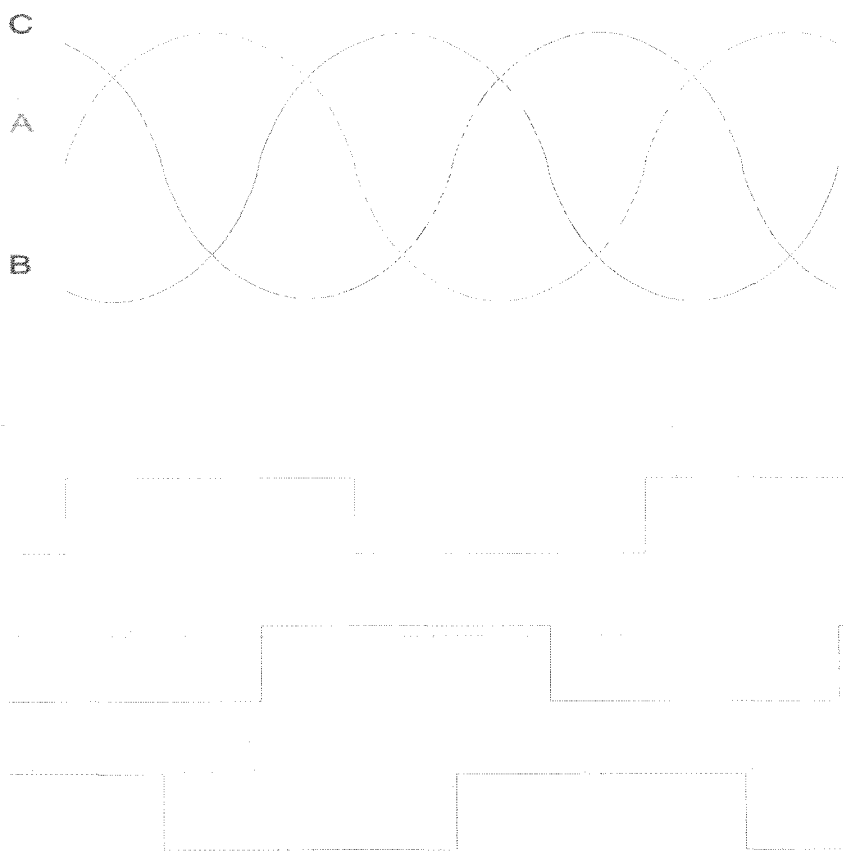
For a six phase machine, each set of encoders (Delta and Wye) must be aligned with the positive going zero crossing of the stator voltage waveform for that particular winding. After this test has been completed, there should be three or six encoders that are aligned with the three or six individual stator voltage zero crossings. Again ensure the probes are clearly identified.

The mark space ratio of the encoder signal should be 50%. If the mark space ratio is not equal then the airgap of the individual sensors should be adjusted to achieve this.

Final check out

Once the above tests have been successfully completed, clearly mark the correct position of the encoder mounting ring with reference to the frame of the machine. Ensure all mechanical fastenings are secure and that the probe terminations are clearly identified at the external termination box.

Stator voltage waveform with respect to encoder signals



Quantity	item	date

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Intermountain Power Service Corporation
Property Removal Permit

To: Security Date: December 21, 2010

From: Jerry Hintze
(Person Authorizing Removal)

The bearer Nathan Crop and 2561
(Name) (Badge Number, if applicable)

is hereby authorized to remove the following material, tool, and/or equipment from the site on: 4/12/2006
(Date)

No.	Qty.	Unit	Model #	Serial #	Complete Description
1	2	n/a	n/a	n/a	ladders
2	1	n/a	n/a	n/a	1 - chain fall
3	2	n/a	n/a	n/a	gang boxes
4	1	n/a	n/a	n/a	miscellaneous - (clevises and harnesses)
5					
6					
7					
8					
9					

If personal equipment, owner signs here: _____

Equipment Loaned Out By: (check the box that applies)

IPSC [ ] Contractor [ ] Other [ ] (please specify): _____

Date Due: _____ Date of Return: _____

Checked in By: _____
(Signature of Security Guard Checking Equipment Back on Site)

To be Completed by Authorizing Person

I hereby certify and attest that all of the above described items are the legal property of, or are under the full and legal control of the above named company or individual, or are the legal property of the bearer.

Signed By: _____ Date: _____

To be Completed by Security

I have checked the above described items and found them to be in apparent agreement with the description.

Signed By: _____ Date: _____ Time: _____ AM / PM

Rev. 2 1/04 cep

IP7014146

Intermountain Power Service Corporation
Property Removal Permit

To: Security Date: December 21, 2010

From: Dennis Killian
(Person Authorizing Removal)

The bearer Nathan Crop (Name) and 2561 (Badge Number, if applicable)

is hereby authorized to remove the following material, tool, and/or equipment from the site on: 4/4/2006 (Date)

No.	Qty.	Unit	Model #	Serial #	Complete Description
1	1	n/a			Cache Valley Fork lift (H&E equipment)
2	1	n/a			Cache Valley Fork Lift (H&E equipment)
3	4	n/a			Cache Valley 8' step ladders
4	1	n/a			Cache Valley 20' ext. ladder
5	4	n/a			Cache Valley Gear equipment dolly's
6	1	n/a			Cache Valley Foot locker w/six harnesses
7	2	n/a			Cache Valley - 25 ton hydraulic jacks
8					
9					

If personal equipment, owner signs here: _____

Equipment Loaned Out By: (check the box that applies)

IPSC [ ] Contractor [ ] Other [ ] (please specify): _____

Date Due: _____ Date of Return: _____

Checked in By: _____
(Signature of Security Guard Checking Equipment Back on Site)

To be Completed by Authorizing Person

I hereby certify and attest that all of the above described items are the legal property of, or are under the full and legal control of the above named company or individual, or are the legal property of the bearer.

Signed By: _____ Date: _____

To be Completed by Security

I have checked the above described items and found them to be in apparent agreement with the description.

Signed By: _____ Date: _____ Time: _____ AM / PM

Rev. 2 1/04 cep

IP7014147

CLEARANCE LIST FOR UNIT ONE ID FAN 1C & 1D REPLACEMENT
MARCH OUTAGE 2005

SOURCE 1C1		LABEL
1APE-SWG-1B2	CUB 2	1CCE-XF-1C1 ID FAN XFMR 1C1
MCC 1B12	10-D	1CCE-EXX-1C1-B ID FAN VAR SP DRV 1C1 (EXCITER)
1APA-PPL-108	BKRS 37,39,41	1CCE-29-1C1 (1CCEK213307)
1APA-PPL-109	BKR 16	1CCE-EXX-1C1 (1CCEK2125B18)
1API-PPL-2	BKR 2	1CCE-EXX-1C1 ID FAN VARIABLE SPEED DRIVE 1C1

SOURCE 1D1		LABEL
1APE-SWG-1B2	CUB4	1CCE-XF-1D1 ID FAN XFMR 1D1
MCC 1B12	11-D	1CCE-EXX-1D2-B ID FAN VAR SP DRV 1D2 (EXCITER)
1APA-PPL-108	BKRS 38,40,42	1CCE-29-1D1 (1CCEK213407)
1APA-PPL-109	BKR 20	1CCE-EXX-1D1 (1CCE2127B18)
1API-PPL-2	BKR 4	1CCE-EXX-1D1 ID FAN VARIABLE SPEED DRIVE 1D1

SOURCE 1C2		LABEL
1APE-SWG-1B2	CUB 3	1CCE-XF-1C2 ID FAN XFMR 1C2
MCC 1B32	1-N	1CCE-EXX-1C2-B ID FAN VAR SP DRV 1C2 (EXCITER)
1APA-PPL-109	BKR 18	1CCE-EXX-1C2 (1CCEK2126B29)
1API-PPL-4	BKR 2	1CCE-EXX-1C2 ID FAN VARIABLE SPEED DRIVE 1C2

SOURCE 1D2		LABEL
1APE-SWG-1B2	CUB 5	1CCE-XF-1D2 ID FAN XFMR 1D2
MCC 1B32	9-F	1CCE-EXX-1D2-B ID FAN VAR SP DRV 1D2 (EXCITER)
1APA-PPL-109	BKR 22	1CCE-EXX-1D2 (2CCEK2128B29)
1API-PPL-4	BKR 4	1CCE-EXX-1D2 ID FAN VARIABLE SPEED DRIVE 1D2

REMOTE I/O	6 LINKS TOTAL	LABEL
	TB5-189,207	1COF-CAB-33 WIRING
	TB7-258,291	
	TB8-313,323	

REMOTE I/O	6 LINKS TOTAL	LABEL
	TB5-189,207	1COF-CAB-34 WIRING
	TB7-258,291	
	TB8-313,323	

Nathan Crop

1/27/2005

IP7014148